(12) INTERNATIONAL APPLICATION PUBLISHED UNDER THE PATENT COOPERATION TREATY (PCT)

(19) World Intellectual Property Organization
International Bureau

(43) International Publication Date
20 February 2003 (20.02.2003)

PCT

(10) International Publication Number
WO 03/013756 A1

(51) International Patent Classification[7]: B21D 22/22, 24/10, B29C 51/26

(21) International Application Number: PCT/EP02/08416

(22) International Filing Date: 29 July 2002 (29.07.2002)

(25) Filing Language: English

(26) Publication Language: English

(30) Priority Data:
0119206.1 6 August 2001 (06.08.2001) GB

(71) Applicant *(for all designated States except US)*: **GIANT-CODE TOOLS A/S** [DK/DK]; Lucernevej 11, Klokkerholm, DK-9320 Hjallerup (DK).

(72) **Inventors; and**

(75) **Inventors/Applicants** *(for US only)*: **CHRISTENSEN, Flemming, Lausen** [DK/DK]; Giantcode Tools A/S, Lucernevej 11, Klokkerholm, DK-9320 Hjallerup (DK). **ANDERSEN, Lars, Birk** [DK/DK]; Giantcode Tools A/S, Lucernevej 11, Klokkerholm, DK-9320 Hjallerup (DK).

(74) Agent: **WALLS, Alan, James**; PO Box 223, Tadworth, Surrey KT20 5YF (GB).

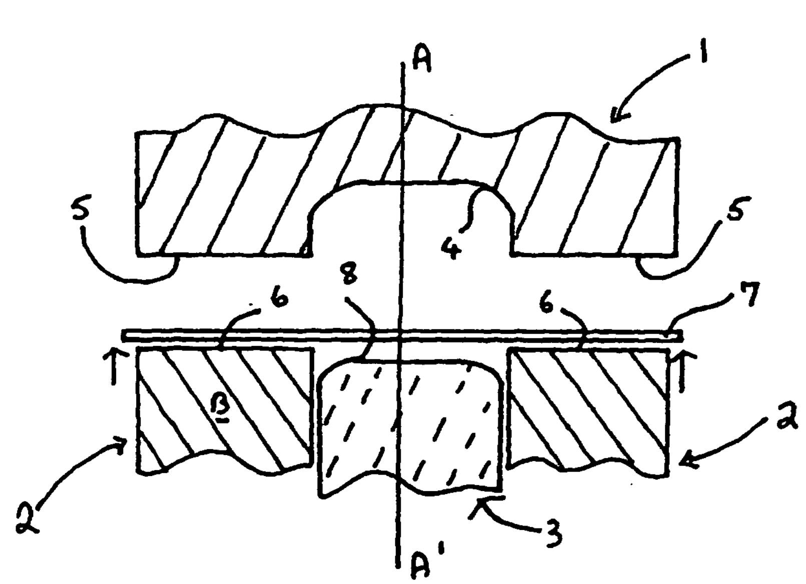
(81) Designated States *(national)*: AE, AG, AL, AM, AT, AU, AZ, BA, BB, BG, BR, BY, BZ, CA, CH, CN, CO, CR, CU, CZ, DE, DK, DM, DZ, EC, EE, ES, FI, GB, GD, GE, GH, GM, HR, HU, ID, IL, IN, IS, JP, KE, KG, KP, KR, KZ, LC, LK, LR, LS, LT, LU, LV, MA, MD, MG, MK, MN, MW, MX, MZ, NO, NZ, OM, PH, PL, PT, RO, RU, SD, SE, SG, SI, SK, SL, TJ, TM, TN, TR, TT, TZ, UA, UG, US, UZ, VN, YU, ZA, ZM, ZW.

(84) Designated States *(regional)*: ARIPO patent (GH, GM, KE, LS, MW, MZ, SD, SL, SZ, TZ, UG, ZM, ZW), Eurasian patent (AM, AZ, BY, KG, KZ, MD, RU, TJ, TM), European patent (AT, BE, BG, CH, CY, CZ, DE, DK, EE, ES, FI, FR, GB, GR, IE, IT, LU, MC, NL, PT, SE, SK, TR), OAPI patent (BF, BJ, CF, CG, CI, CM, GA, GN, GQ, GW, ML, MR, NE, SN, TD, TG).

Published:
— *with international search report*

For two-letter codes and other abbreviations, refer to the "Guidance Notes on Codes and Abbreviations" appearing at the beginning of each regular issue of the PCT Gazette.

(54) Title: BLANK HOLDER MEANS FOR DRAWING PRESS



(57) Abstract: A press for forming sheet material comprising an upper blank holder die element (1) and a lower blank holder element (1) capable of being brought into engagement for clamping a blank (7) between their respective clamping surfaces (5, 6); and a ram (3) for pressing a clamped blank, the clamping surface of the lower blank holder element being backed by a support block having volume of differing moduli of elasticity so that the resistance to compression of the clamping surface varies and the clamping force experienced by the blank when clamped between the die and the lower blank holder element also varies.

WO 03/013756 A1

Blank Holder Means For Drawing Press

This invention relates to improvements in the blank holder component of presses for forming sheet materials such as plastics and metals, enabling the clamping force experienced by a blank when held in the blank holder to be higher in some clamped areas than in others.

Background to the Invention

In drawing, stamping, pressing or otherwise forming sheet material blanks into shaped parts, the blank is usually clamped between upper and lower elements of a blank holder component while the pressing ram component presses the unclamped areas into the die. The forces involved in the pressing operation can be substantial, and some slippage of the clamped areas of the blank may occur during pressing. The stretching forces experienced by different regions of the clamped area are likely to vary in cases where the pressing is irregularly shaped, resulting in different degrees of slippage in different clamped areas. Often any such slippage will be undesirable, best pressing results being expected when the blank is firmly immobilised by the blank holder. However, sometimes a degree of slippage in some clamped is actually desirable, to avoid rupture or malformation of the pressing.

In the case where no slippage is to be tolerated, one solution may be to increase the overall blank holder force to the level necessary to securely clamp those clamped areas subject to the greatest stretching force during the pressing stage. However, at least in principle, a more sophisticated solution may be to apply higher clamping forces to those areas experiencing the greatest stretching forces than to those areas subject to low stretch. In the case where some slippage in some clamped areas is desirable, the latter may be the only viable solution.

One known method of applying different blank holder force to some areas of the clamped blank than others is to use one or more piston/cylinder

combinations acting on elements of the blank holder.

Brief Description of the Invention

This invention makes available an alternative to the known piston/cylinder arrangement for controlling the blank holder force in different areas of the clamped blank. This is done by backing a clamping surface of the blank holder with a support block having volume domains of differing moduli of elasticity, in a manner more fully described hereafter.

Detailed Description of the Invention

According to the invention there is provided a press for forming sheet material comprising

a die having a clamping surface, constituting an upper blank holder element;

a lower blank holder element having a clamping surface, constituting means for supporting a sheet material blank placed thereon;

the die and lower blank holder element being capable of being brought into engagement for clamping at least localised areas of the sheet material blank between their respective clamping surfaces; and

a ram which is shaped for pressing the sheet material blank into a desired shape while the blank is clamped between opposed clamping surfaces of the die and lower blank holder element;

CHARACTERISED IN THAT

the clamping surface of the lower blank holder element is backed by a support block, for controlling the resistance to compression of areas of the clamping surface by force applied perpendicular thereto,

at least a first volume domain of the support block having a higher modulus of elasticity than a second volume domain thereof,

so that the resistance to such compression of a first area of the clamping surface which is backed by the first volume domain of the support block is higher than that of a second area thereof which is backed by the second volume domain,

whereby the clamping force experienced by the blank when clamped between the die and the lower blank holder element is greater for the part of the blank in contact with the first area than for the part in contact with the second area.

CLAMPING SURFACE

The clamping surface of the lower blank holder element will be shaped in accordance with the design of the workpiece to be produced by the press. In many cases it will be flat, but in others it will have a shape corresponding to part of the eventual workpiece shape. The clamping surface may be that of a metal sheet, formed or machined to the desired shape. One type of clamping surface may be provided by an electroformed nickel or nickel alloy sheet. The surface may be roughened, either overall or in localised areas, to increase friction between the clamped workpiece and the elements of the blank holder during the pressing operation.

Where the clamping surface is provided by a flat or shaped sheet distinct from the support block, it may be bonded, clamped or otherwise fixed to the backing support block. In some cases the clamping surface may simply be a surface of the support block itself

SUPPORT BLOCK

The function of the support block is to back the clamping surface to provide a secure and relatively rigid lower blank holder element, and to control the

resistance to compression of areas of the clamping surface during clamping.

To control compression resistance, the blank holder is constructed with volume domains of differing moduli of elasticity. At least a first volume domain has a higher modulus of elasticity than a second volume domain thereof. Since the support block as a whole provides a backing for the clamping surface, the resistance to compression of an area of the surface backed by a higher modulus volume domain of the support block is greater than that of an area backed by a domain of lower modulus. In this way, the clamping force experienced by the blank when clamped between the die and the lower blank holder element is greater for the part of the blank in contact with the first area than for the part in contact with the second area.

By designing the support block with multiple volume domains, each having a desired modulus of elasticity, a desired pattern of resistance to compression may be imposed on the clamping surface. Hence the clamping force experienced by the blank when clamped between the die and the lower blank holder element may be arranged to be greater in some areas than in others. Areas of the clamped part of the blank which must be completely immobilised during pressing should be in contact with areas of the clamping surface backed by volume domains in the support block which have a modulus high enough to ensure high clamping force in those areas. Conversely areas of the blank which are to be permitted some slippage during pressing should be in contact with areas of the clamping surface backed by domains having a modulus which ensures the appropriate clamping force permitting that slippage.

As non-limiting examples of support block constructions providing multiple volume domains of differing moduli of elasticity may be mentioned the "continuous solid mass", "discrete solid mass" and "pressurised chamber" embodiments discussed below.

"Continuous Solid Mass"

In this embodiment of a support block construction for use in accordance with the invention, the block is a continuously solid mass. Given volume domains of the mass have compositions providing the desired modulus of elasticity. Thus, for example, a domain of higher modulus may be provided by a stiff, minimally compressible material such as a cement matrix or a ceramic, preferably reinforced by lump and/or particle and/or fibre reinforcement to minimise the risk of fracture under high clamping force loads; while a domain of lower modulus may be provided by a less stiff, more compressible material such as a metal or plastics, again preferably containing reinforcement as aforesaid. Of course, by varying the amount and type of reinforcement, and the compounding method for the reinforced composite, the modulus of elasticity for any given base material (e.g. cement, metal, ceramic, or plastic, including such materials when compounded as composites) may be varied.

An advantage of this type of support block construction is that the domains of the continuously solid mass may be cast in a fluid state then hardened. Each domain may be cast separately, and allowed to harden before an adjacent domain is cast and hardened. In this way the continuously solid mass may be built up stepwise, domain-by-domain. In some cases, it may be feasible to prepare batches of castable material each having the composition to provide a required modulus of elasticity, and then to cast the entire support block by casting the different batches in the desired domain pattern so that the fluid batches abut each other and the mass hardens as a whole.

By casting against a mould having the contours of the desired clamping surface, the surface of the support block itself may provide the clamping surface. More usually however, the clamping surface will be provided by a metal sheet, as discussed above. In that case the domains of the support block may be cast directly against that sheet, or indirectly against that sheet via an intermediate body designed to enhance the adhesion between

the sheet and cast mass. If desired, keying elements such as studs may be fixed to or formed as part of the surface of the sheet against which the mass is cast, so that the sheet becomes keyed into the cast mass.

"Discrete Solid Mass"

In this embodiment of a support block construction for use in accordance with the invention, the block comprises a plurality of walled chambers, each containing a snugly fitting discrete continuously solid mass, each discrete mass constituting a volume domain of the support block. Each discrete mass has a composition providing the desired modulus of elasticity, achieved by the use of materials discussed in connection with the "continuous solid mass" embodiment.

The discrete solid masses may be cast in a fluid state into their respective walled chambers directly or indirectly against the sheet, then hardened. Alternatively, each discrete mass may be cast separately in a shape conforming to the shape of the walled chamber for which it is destined. The advantage of such an arrangement is that the support block may be constructed as a honeycomb of standard sized walled chambers, and the discrete masses may be prepared as a kit of masses of differing moduli of elasticity which are then insertable into and removable from their respective walled chambers. In this way the support block may be assembled, disassembled and reassembled many times, with any desired pattern of volume domains.

"Pressurised Chamber"

In this embodiment of a support block construction for use in accordance with the invention, the block includes at least two walled pressurised chambers, capable of being pressurised to different pressures, each constituting a volume domain of the support block. The chambers are pressurised hydraulically or pneumatically, and the pressure in the chambers may adjustable prior to or during operation of the press.

A support block in accordance with this embodiment may resemble somewhat the honeycomb construction described in relation to the "discrete solid mass" embodiment. In this case, the support block may contain a plurality of chambers, defined by substantially rigid side and bottom walls, the top walls of which are defined by the clamping surface of the lower blank holder element. In this way, when the chambers are pressurised, they behave as volume domains having moduli of elasticity proportionate to the pressure within. It will often be convenient to achieve pressurisation of the chambers by inflating balloons located within the chambers.

This embodiment has the advantage that a support block having any desired pattern of volume domains of differing moduli may be created simply by pressurising the various chambers to the desired levels. The support block may them be reconfigured for a different blank by repressurising thechambers to create the desired new domain pattern. Furthermore, in cases where long pressing runs may degrade the clamping forces created by the blank holder, repressurisation of the chambers may compensate for such degradation.

Embodiments of the invention will now be described by reference to the following drawings wherein:

Fig 1 shows a cross section of typical pressing apparatus to which the improvement of the present invention may be applied and

Figs 2-6 show various design features of the lower blank holder element of the apparatus of Fig 1, these design features being in accordance with the invention.

In Fig 1, the cooperating parts of a die 1, a lower blank holder element 2, and a ram 3, each cylindrically symmetrical about axis A-A', are shown in cross section. A concave depression is formed in the lower surface of die

1, dividing that surface into a concave feature 4 and a flat surface area 5, concentric about the concave feature. The part of die 1 presenting flat surface 5 constitutes an upper blank holder element of the apparatus, as will be described below.

Lower blank holder element 2 has a flat clamping surface 6, essentially co-extensive with surface 5 of the die, which supports a sheet metal blank 7. Lower blank holder element 2 is moveable parallel to axis A-A' by hydraulic means (not shown) into and out of engagement with the upper blank holder element of the die 1, whereby its clamping surface 6 and the surface 5 of the upper blank holder element of the die are forced into clamping contact. Hence the sheet metal blank 7 supported on the clamping surface 6 of the lower blank holder 2 may be clamped between surface 6 of the lower blank holder element and clamping surface 5 of the upper blank holder element.

The ram 3 has an operative nose part 8, shaped as a male counterpart of the concave feature 3 of die 1. Ram 3 is moveable parallel to axis A-A' by hydraulic means (not shown) into and out of engagement with the concave feature of the die. Hence, in operation of the apparatus of Fig 1, the blank 7 is clamped between clamping surfaces 5 and 6 of the upper and lower blank holder elements, and the ram 3 presses the unclamped portion of the blank into the concave feature 4 of the die 1. The pressed blank is then released.

As the ram 3 presses the blank into the concave feature 4, stretching forces are exerted on the blank. Depending on the geometry of the final pressed item, those stretching forces may be so severe that wrinkling, tearing or other stress damage will occur. With the concave shape 4 shown in Fig 1, it is to be expected that stretching will be greater in the wall region from the rim to floor of the concave feature, than in the floor area itself. This extra stretching in the wall region will at least result in thinner metal in that area than in the floor and clamped regions. To minimise that thinning, it may be desirable to allow for some slippage of the clamped blank during

the ramming cycle, and it may e desirable to allow greater slippage of the clamped part of the blank nearer the rim of the concave feature that at the more remote clamped parts of the blank.

The present invention is concerned with ways of achieving this, by particular design features of the lower blank holder element. Hence, the invention will be illustrated by reference to features of the design of element 2 of Fig 1.

Fig 2 shows the part of the lower blank holder element indicated as B in Fig. 1 constructed in accordance with one aspect of the invention. (It will be remembered that the lower blank holder element 2 in Fig 1 is cylindrically symmetrical about axis A-A', so the view shown in Fig 2 is a cross section through one section of the cylinder body. However, the invention is nt restricted to a particular configuration of lower blank holder element.)

The clamping surface 6 of the lower blank holder element 2 is the upper surface of a support block consisting of two masses 9 and 10 which are concentric about axis A-A' (Fig 1). Mass 9 has a higher modulus of elasticity than mass 10. Thus, mass 9 may be of a DSP material as previously described, while mass 10 may be of a resin material, containing particulate and/or granulate fillers and fibre reinforcement. The precise compositions of the two masses will be determined by their desired moduli.

Masses 9 and 10 may be separately cast into appropriately cylinder-shaped moulds, then the hardened mass 10 may be placed inside mass 9, and optionally bonded thereto at interface 11 by adhesive or by mechanical fixing means, to form the support block for clamping surface 6 of lower blank holder 2. Preferably, however, mass 9 is first cast into an appropriately shaped mould, and allowed to harden. Then mass 10 is cast against the inner wall 11 of hardened mass 9 and allowed to harden in contact therewith. To provide good connection between the two masses 9 and 10, keying elements 12, such as stone granules or metal studs may be

fixed to the hardened inner wall 11 of the mass 9. Alternatively masses 9 and 10 may be simultaneously cast in appropriate moulds with a common wall 11, which may have keying elements 12 bonded to one or both sides, so that after hardening of both masses the common wall 11 of the mould remains in place as an integral part of the blank holder element.

However masses 9 and 10 of the support block may be formed, the clamping surface 6 may be machined or otherwise post-treated to ensure the desired dimensional and frictional tolerances of the clamping surface are achieved.

In accordance with the invention, therefore, the clamping surface 6 of the lower blank holder element 2 is backed by a support block 9/10, for controlling the resistance to compression of areas of the clamping surface by force applied perpendicular thereto, volume domain 9 of the support block having a higher modulus of elasticity than volume domain 10 thereof, so that the resistance to such compression of the area of the clamping surface which is backed by volume domain 9 of the support block is higher than that of the area thereof which is backed by volume domain 10, whereby the clamping force experienced by the blank when clamped between the die 1 and the lower blank holder element 2 is greater for the part of the blank in contact with the former area than for the part in contact with the latter area.

Fig 3 is identical to Fig 2, except that the clamping surface, now designated 16, is not the bare surface of the support block 9/10, but rather the upper surface of a preformed sheet of metal or metal alloy, for example an electroformed nickel or nickel alloy sheet. The under surface of the sheet may have keying elements 13 fixed thereto, and the masses 9 and 10 may be cast against the under surface by using the sheet as the base of appropriate mould.

Fig 4 shows the lower blank holder 2 with a clamping surface 16

constituted by the upper surface of a metal or metal alloy sheet, and with optional keying elements 13 fixed to the under surface thereof, all as in Fig 3. However, in this embodiment, the backing mass 20 is a monolithic cast mass whose modulus of elasticity decreases continuously or in discrete steps in the direction of the arrow. This is achieved by varying the composition of the backing mass material, either continuously or in discrete stages, as the mould is filled with casting material across its width.

Fig 5 shows the lower blank holder 2 with a clamping surface 16 constituted by the upper surface of a metal or metal alloy sheet as in Fig 3. However, in this embodiment, the support block is constructed as a honeycomb like structure of walled chambers 21. The walls 22 of the chambers are fixed at their top ends, for example by welding or soldering, to the underside of the metal sheet providing clamping surface 16, and at their bottom ends to a removable base plate 23. Chambers 21 are preferably of similar dimensions, and each is adapted snugly to accommodate a block of backing material having a desired modulus of elasticity. An array of appropriately shaped blocks having a range of moduli may be pre-prepared, for insertion into the chambers 21 in any desired pattern.

When this embodiment of the invention is assembled, the clamping surface 16 of the blank holder 2 is backed by a support block consisting of the metal sheet providing the lamping surface, the honeycomb of walled chambers 21/22, the blocks snugly accommodated in those chambers, and the base plate 23. This support block controls the resistance to compression of areas of the clamping surface by force applied perpendicular thereto, since each block in each chamber constitutes a volume domain of the support block having a modulus of elasticity different from other blocks of differing moduli, so that the resistance to such compression of the area of the clamping surface which is backed by a chamber of the support block containing a high modulus block is higher than that of the area thereof which is backed by a chamber having a block

of lower, whereby the clamping force experienced by the blank when clamped between the die 1 and the lower blank holder element 2 is greater for the part of the blank in contact with the former area than for the part in contact with the latter area.

Fig 6 shows the lower blank holder 2 with a clamping surface 16 constituted by the upper surface of a metal or metal alloy sheet as in Fig 3. However, in this embodiment, the support block is constructed with substantially rigid peripheral walls 24, fixed at their top ends, for example by welding or soldering, to the underside of the metal sheet providing clamping surface 16, and at their bottom ends to a removable base plate 23. The interior of the support block defined by the metal sheet, peripheral walls and base plate is divided into a plurality of chambers by substantially rigid partition walls 27 which are also fixed at their top ends to the underside of the metal sheet providing clamping surface 16, and at their bottom ends to a removable base plate 23. Each chamber contains a hydraulically or pneumatically expandable and contractible bag 25, for example of heavy-duty synthetic rubber. These bags when expanded are contained by the rigid peripheral and partition walls 24 and 27, by base plate 23, and by the metal sheet providing the clamping surface 16. The bags may be expanded and contracted by hydraulic or pneumatic means (not shown) to provide any desired degree of pressurisation. These chambers constitute volume domains of the support block for clamping surface 16, and the modulus of elasticity of the each chamber is proportional to its degree of pressurisation. Thus this embodiment of the invention also allows different areas of the clamping surface 16 to be backed by volume domains of the support block having differing moduli, and thus to perform in accordance with the principles embodied in the embodiments of Figs 2-5

Claims

1. A press for forming sheet material comprising

a die having a clamping surface, constituting an upper blank holder element;

a lower blank holder element having a clamping surface, constituting means for supporting a sheet material blank placed thereon;

the die and lower blank holder element being capable of being brought into engagement for clamping at least localised areas of the sheet material blank between their respective clamping surfaces; and

a ram which is shaped for pressing the sheet material blank into a desired shape while the blank is clamped between opposed clamping surfaces of the die and lower blank holder element;

CHARACTERISED IN THAT

the clamping surface of the lower blank holder element is backed by a support block, for controlling the resistance to compression of areas of the clamping surface by force applied perpendicular thereto,

at least a first volume domain of the support block having a higher modulus of elasticity than a second volume domain thereof,

so that the resistance to such compression of a first area of the clamping surface which is backed by the first volume domain of the support block is higher than that of a second area thereof which is backed by the second volume domain,

whereby the clamping force experienced by the blank when clamped

between the die and the lower blank holder element is greater for the part of the blank in contact with the first area than for the part in contact with the second area.

2. A press as claimed in claim 1 wherein the clamping surface of the lower blank holder comprises areas in addition to the first and second areas, each backed by a volume domain of the backing mass having a desired modulus of elasticity.

3. A press as claimed in claim 1 or claim 2 wherein the clamping surface of the lower blank holder is provided by a flat or shaped metal sheet, for example of electroformed nickel or nickel alloy, backed by the support block.

4. A press as claimed in any of claims 1 to 3 wherein the support block is a continuously solid mass.

5. A press as claimed in claim 3 wherein the support block is a continuously solid mass cast in a fluid state directly or indirectly against the sheet then hardened.

6. A press as claimed in any of claims 1 to 3 wherein the support block comprises a plurality of walled chambers, each containing a snugly fitting discrete continuously solid mass, each discrete mass constituting a volume domain of the support block.

7 A press as claimed in claim 6 wherein the discrete continuously solid masses are cast in a fluid state into their respective walled chambers directly or indirectly against the sheet, then hardened.

8. A press as claimed in claim 6 wherein the discrete continuously solid masses are insertable into and removable from their respective walled chambers.

9. A press as claimed in any of claims 1 to 8 wherein the volume domains of the support block are composed of materials selected from cementacious, ceramic, metal or resin materials, each optionally reinforced by particulate and/or fibre reinforcement materials.

10. A press as claimed in any of claims 1 to 3 wherein the support block includes at least two walled pressurised chambers capable of being pressurised to different pressures, each constituting a volume domain of the support block.

11. A press as claimed in claim 10, wherein the chambers are pressurised hydraulically or pneumatically.

12. A press as claimed in claim 10 or claim 11 wherein the pressure in the chambers is adjustable prior to or during operation of the press.

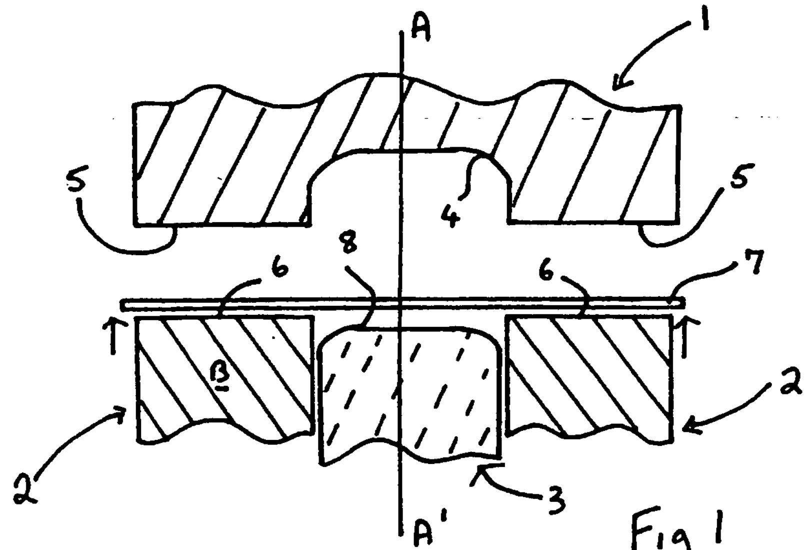


Fig 1

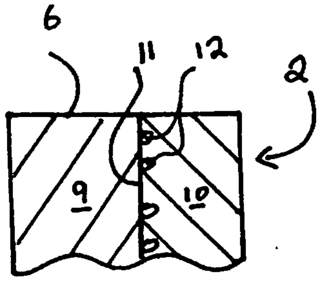


Fig 2

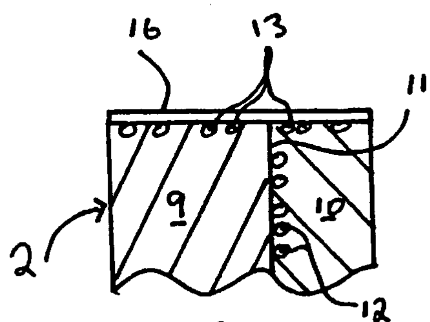


Fig 3

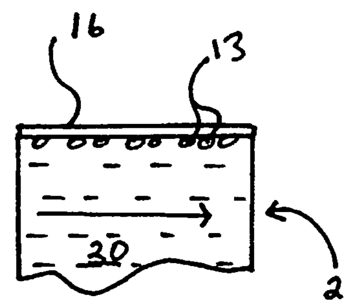


Fig 4

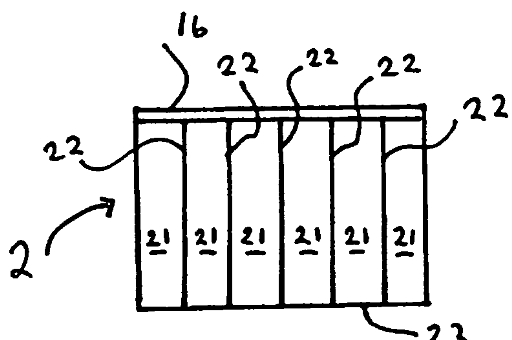


Fig 5

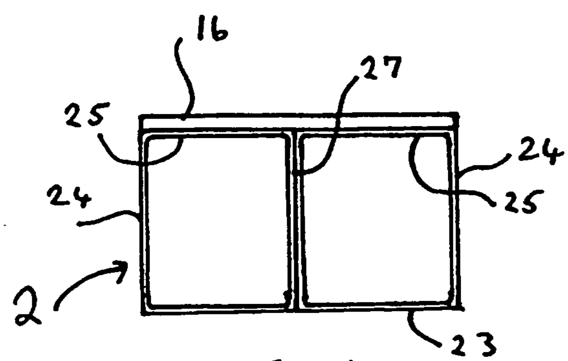


Fig 6

INTERNATIONAL SEARCH REPORT

International Application No
PCT/EP 02/08416

A. CLASSIFICATION OF SUBJECT MATTER
IPC 7 B21D22/22 B21D24/10 B29C51/26

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)
IPC 7 B21D B29C

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practical, search terms used)

EPO-Internal, PAJ, WPI Data

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category °	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	FR 884 771 A (HELFEDA S A) 26 August 1943 (1943-08-26) page 3, line 98 - line 101; figures	1-4,6,8, 9
X	WO 96 24449 A (HECRALMAT ;PIRCHL GERHARD (CH)) 15 August 1996 (1996-08-15) the whole document	1,2,9
A	US 4 745 792 A (STORY JAMES M ET AL) 24 May 1988 (1988-05-24) the whole document	10-12

☐ Further documents are listed in the continuation of box C.

☒ Patent family members are listed in annex.

° Special categories of cited documents :

"A" document defining the general state of the art which is not considered to be of particular relevance

"E" earlier document but published on or after the international filing date

"L" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)

"O" document referring to an oral disclosure, use, exhibition or other means

"P" document published prior to the international filing date but later than the priority date claimed

"T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention

"X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone

"Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art.

"&" document member of the same patent family

Date of the actual completion of the international search	Date of mailing of the international search report
11 November 2002	29/11/2002

Name and mailing address of the ISA	Authorized officer
European Patent Office, P.B. 5818 Patentlaan 2 NL – 2280 HV Rijswijk Tel. (+31-70) 340-2040, Tx. 31 651 epo nl, Fax: (+31-70) 340-3016	Ris, M

INTERNATIONAL SEARCH REPORT

Information on patent family members

International Application No
PCT/EP 02/08416

Patent document cited in search report		Publication date	Patent family member(s)			Publication date
FR 884771	A	26-08-1943	NONE			
WO 9624449	A	15-08-1996	DE	19503874	A1	08-08-1996
			AT	197258	T	15-11-2000
			AU	4622596	A	27-08-1996
			DE	59606093	D1	07-12-2000
			WO	9624449	A1	15-08-1996
			EP	0808224	A1	26-11-1997
			JP	11508490	T	27-07-1999
			US	6354131	B1	12-03-2002
US 4745792	A	24-05-1988	NONE			